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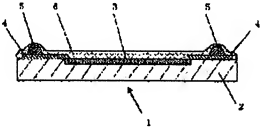
(54) ELECTRONIC COMPONENT, METHOD FOR MANUFACTURING ELECTRONIC COMPONENT AND METHOD FOR MANUFACTURING ELECTRONIC CIRCUIT DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide structure wherein projecting electrodes are not contaminated or oxidized while an electronic component is manufactured and mounted on a circuit board, in an electronic component which is connected with the circuit board by using the projecting electrodes, and provide a method for manufacturing the electronic component and a method for manufacturing an electronic circuit device.

SOLUTION: The electronic component 1 is provided with projecting electrodes 5 formed on connection terminals 4 of a substrate 2 provided with a circuit element 3, and a protective film 6 which is formed covering the circuit element 3 and the electrodes 5. While the electronic component 1 is manufacture and mounted on the circuit board, the electrodes 5 are not contaminated or oxidized, so that bonding to connection terminals of the circuit board can be realized with high reliability.



1 半導体部品（電子部品）
2 半導体基板（基板）
3 半導体デバイス（回路素子）
4 接続電極
5 突起電極
6 保護膜（保護膜）

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CLAIMS

[Claim(s)]

[Claim 1] Electronic parts which have the protective coat which covered the projection electrode formed on the connection electrode of the substrate equipped with the circuit element, and said circuit element, said substrate and said projection electrode, and was formed.

[Claim 2] Electronic parts according to claim 1 to which a substrate is characterized by a circuit element being a semiconductor device with a semiconductor substrate.

[Claim 3] Electronic parts which have the protective coat which covered the projection electrode formed on the connection electrode of the substrate equipped with the circuit element, the lid of the hollow which covered said circuit element at least and was prepared, and said substrate, said projection electrode and said lid, and was formed.

[Claim 4] Electronic parts according to claim 3 to which a substrate is characterized by a circuit element being a surface acoustic wave device with a piezo-electric substrate.

[Claim 5] Electronic parts according to claim 1 or 3 with which a protective coat is characterized by being an oxide film, a nitride, or an oxidation nitride.
[Claim 6] Electronic parts according to claim 1 or 3 with which a protective coat is characterized by being resin of thermosetting, thermoplasticity, or an ultraviolet curing mold.
[Claim 7] Electronic parts according to claim 5 or 6 characterized by the thickness of the protective coat in the top head of a projection electrode being thinner than the thickness in other fields.
[Claim 8] The process which forms on a substrate wiring which has a circuit element and a connection electrode, and the process which forms a projection electrode on said connection electrode, The process which carries out adsorption immobilization of said substrate on the process which covers said circuit element and forms a lid in the air, and the rotation base of a rotation coater, rotates after resin is dropped at said substrate, covers said substrate, said lid, and said projection electrode, and forms the resin film, The manufacture approach of electronic parts of having the process divided into each electronic parts after stiffening said resin film.
[Claim 9] The manufacture approach of the electronic parts according to claim 8 characterized by the ability of the revolving shaft of a rotation coater to incline from a vertical to the include angle of arbitration.
[Claim 10] The manufacture approach of the electronic parts according to claim 8 or 9 characterized by performing at least one of the impressing a supersonic wave to a substrate after dropping heating a substrate to the temperature below the hardening initiation temperature of resin before and after dropping resin at a substrate, and resin.
[Claim 11] The manufacture approach of the electronic parts according to claim 8 characterized by adding the process which decompresses and carries out degassing of the container after resin is dropped at the substrate by which the container of a rotation coater which surrounds a rotation base at least is constituted possible [reduced pressure], and adsorption immobilization was

carried out on said rotation base.

[Claim 12] The manufacture approach of electronic-circuitry equipment of having the process which makes ultrasonic connection of the process which carries out alignment of the projection electrode of electronic parts according to claim 1 to 7 to the connection terminal on the circuit board, and said projection electrode and said connection terminal.

[Claim 13] The manufacture approach of electronic-circuitry equipment according to claim 12 that a projection electrode is characterized by having a thin height compared with the overall diameter of a projection electrode on a top head.

[Claim 14] The manufacture approach of the electronic-circuitry equipment according to claim 12 characterized by applying heat to electronic parts with a supersonic wave in the process which makes ultrasonic connection.

[Claim 15] The manufacture approach of the electronic-circuitry equipment according to claim 12 characterized by impressing a supersonic wave after the process which makes ultrasonic connection carries out the pressure welding of the projection electrode to a connection terminal and crushes the protective coat of the top head of said projection electrode.

[Claim 16] The manufacture approach of the electronic-circuitry equipment according to claim 12 which the circuit board is a ceramic substrate or a metal substrate which has an insulating layer in a principal plane at least, and is characterized by supplying a supersonic wave from both by the side of electronic parts and the circuit board.

[Claim 17] The manufacture approach of the electronic-circuitry equipment according to claim 16 characterized by the energy of the supersonic wave supplied from a circuit board side being size compared with the energy of the supersonic wave supplied from an electronic-parts side.

[Claim 18] Before the process which carries out alignment, the projection electrode of electronic parts, and the connection terminal of the circuit board By performing at least rotation or one side of carrying out a horizontal movement, pressing said projection electrode to the level pedestal the front face of whose is

a split face for polish, and sliding electronic parts in a horizontal plane, and a level pedestal The manufacture approach of the electronic-circuitry equipment according to claim 12 characterized by adding the process which crushes the protective coat of the top head of said projection electrode.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to electronic parts excellent in dependability, the manufacture approach of the electronic parts, and the manufacture approach of electronic-circuitry equipment.

[0002]

[Description of the Prior Art] In recent years, the request of thin-shape[small and a light weight, and]-izing of the personal digital assistant device which makes a cellular phone the start becomes strong, and many related ED has been performed. Therefore, small and lightweight-izing of the electronic parts containing semi-conductor components, and small and light weight, and thin shape-ization of electronic-circuitry equipment using they further are becoming

indispensable. Thus, since the area in the connection of the electrode of electronic parts and the connection terminal of the circuit board becomes small as electronic parts are miniaturized, the new technique for securing the dependability of a connection is needed.

[0003] About a miniaturization and thin-shape-izing of semi-conductor components, chip scale package (henceforth CSP) structure is developed, and this technique has been applied to RF electronic parts etc. one by one in addition to semi-conductor components.

[0004] About the semi-conductor components of CSP structure, much respectively characteristic structure and many manufacture approaches are developed. For example, to JP,9-237806,A and JP,11-274241,A, after forming projection electrodes, such as a solder bump and a golden ball bump, in the connection electrode of semi-conductor components, a projection electrode is covered completely, and after forming and stiffening the resin film, the front face of the resin film is ground, the front face of a projection electrode is exposed, and the approach of dividing into each semi-conductor components and the approach of connecting those semi-conductor components to the circuit board are indicated. these approaches are markedly boiled as compared with the semi-conductor components of the CSP structure by the conventional resin mold method, and enable thin-shape-izing and a miniaturization.

[0005] Moreover, also about electronic parts equipped with the surface acoustic wave device, the electronic parts which have the structure which formed the projection electrode in the connection electrode of a surface acoustic wave device, and put the lid on the active region of a surface acoustic wave device, and the above-mentioned electronic parts are connected to the circuit board, and the structure which covered the lid by protection resin is indicated by JP,9-246905,A.

[0006] Hereafter, the manufacture approach of the conventional electronic parts and electronic parts and the manufacture approach of the electronic-circuitry equipment using it are explained, referring to drawing 8 and drawing 9 .

[0007] It is a process sectional view for drawing 8 (e) to explain the manufacture approach of the conventional electronic parts which make semi-conductor components an example, and electronic-circuitry equipment from drawing 8 (a).
[0008] First, as shown in drawing 8 (a), on the semi-conductor substrate 30, many semi-conductor components (not shown) equipped with circuit elements, such as a transistor and resistance, are formed, and the projection electrode 31 is formed on the connection electrode (not shown) of the semi-conductor component. Moreover, 32 shows the cutting plane line (henceforth a cutting plane line) of the imagination for dividing the semi-conductor substrate 30 into each semi-conductor components.
[0009] Next, as shown in drawing 8 (b), a spin coat method is used all over the semi-conductor substrate 30, the projection electrode 31 is covered completely, and the resin film 33 is formed. next, the front face of the resin film 33 formed in the principal plane of the semi-conductor substrate 30 -- polish -- or grinding is carried out, the tip front face (henceforth a top head) 34 of the projection electrode 31 is exposed, and the configuration of drawing 8 (c) is acquired. Next, dicing is carried out along with the path cord 32 of the semi-conductor substrate 30, and it divides into each semi-conductor components 35.
[0010] Next, as shown in drawing 8 (d), after preparing the connection terminal 37 and the circuit board 36 in which the internal wiring 38 grade was formed, attracting and holding the semi-conductor components 35 by the vacuum chuck 39 and carrying out alignment of the projection electrode 31 to the connection terminal 37, a supersonic wave is supplied to a vacuum chuck 39, and the projection electrode 31 and the connection terminal 37 are joined.
[0011] Next, as shown in drawing 8 (e), even if there are few semi-conductor components 35, a periphery is covered and protected by the resin film 40. Moreover, there is also an example which covered the semi-conductor components 35 altogether and formed the resin film 40.
[0012] Drawing 9 is an important section sectional view explaining the example of the electronic-circuitry equipment using electronic parts equipped with the

surface acoustic wave device. As shown in drawing 9 , on the circuit board 41, the internal wiring 42 and the connection terminal 43 are formed. On the other hand, the surface acoustic wave device (not shown) is formed in electronic parts 44, and the lid 46 which covers the active region of the surface acoustic wave device, and has oscillating space is formed. 47 is the resin film.

[0013] Electronic parts equipped with such a surface acoustic wave device are manufactured by the manufacture approach of having the process which forms the lid 46 which covers the process which forms many surface acoustic wave devices on the piezo-electric substrate 41, and the active region of a surface acoustic wave device, and has oscillating space, the process which forms the projection electrode 45 on a connection electrode, and the process divided into each electronic parts 44.

[0014] Thus, after carrying out alignment of the projection electrode 45 of the obtained electronic parts 44 to the connection terminal 43 on the circuit board 41, a supersonic wave is impressed to electronic parts and the projection electrode 45 and the connection terminal 43 are joined to them. After that, the electronic-circuitry equipment which carried the surface acoustic wave device will be formed by covering the periphery of electronic parts 44, or the whole electronic parts by the resin film 47.

[0015]

[Problem(s) to be Solved by the Invention] however, the condition of the semi-conductor substrate after forming a projection electrode in the manufacture approach of the above-mentioned conventional semi-conductor components -- a front face -- resin -- applying -- resin -- polish -- or grinding is carried out and the front face of a projection electrode is exposed. It had the technical problem that it was difficult for homogeneity polish or to carry out grinding, and the process itself increased the resin film formed on the semi-conductor substrate of the diameter of macrostomia with a diameter of 20cm.

[0016] Moreover, although divided into the semi-conductor components of each [the condition of having exposed the top head of a projection electrode], it had

to be kept so that the top head of a projection electrode might not be polluted, by the time it mounted semi-conductor components in the circuit board after it. When the projection electrode consists of gold, it is satisfactory, but when it consists of metals which are easy to oxidize, the front face of a projection electrode may oxidize.

[0017] Moreover, after having the same technical problem as the above-mentioned semi-conductor components also in the manufacture approach of the electronic parts which have the above-mentioned conventional surface acoustic wave device, and electronic-circuitry equipment and mounting electronic parts in the circuit board, since it was not able to say that the reinforcement of a lid is enough in the process till then, by the approach of protecting a periphery by resin, it had the technical problem that the handling took careful cautions.

[0018] Moreover, although the surface acoustic wave device forms the IDT electrode and the connection electrode in the principal plane of a piezo-electric substrate by the aluminum film, in fields other than the field covered with the lid, the aluminum film is exposed. Moreover, on the connection electrode which consists of aluminum film, a golden ball bump is formed as a projection electrode. Although cooling water is poured on a substrate in a dicing process, permeation of the water to the corrosion and the lid of an electrode by this cooling water may occur.

[0019] Moreover, as a piezo-electric substrate, although LiTaO3 and LiNbO3 are used, with these ingredients, cooling water may become alkalinity with the cutting powder generated at the time of dicing. Therefore, the aluminum film may be corroded, and when the golden ball bump is formed on the connection electrode which consists of aluminum film, galvanic corrosion may occur in the interface.

[0020] This invention solves the above-mentioned conventional technical problem, and it aims at realizing the electronic parts which protected also mechanically the principal planes of electronic parts including the top head of a projection electrode also in environment, its manufacture approach, and the manufacture approach of the electronic-circuitry equipment using the electronic

parts.

[0021]

[Means for Solving the Problem] In order to attain this purpose the electronic parts of this invention The projection electrode formed on the connection electrode of the substrate equipped with the circuit element, and a substrate, It is what has the protective coat which covered the circuit element and the projection electrode and was formed. The tip front face of a projection electrode can be normally held until it mounts electronic parts in the circuit board, and the manufacture approach of electronic parts and the manufacture approach of the electronic-circuitry equipment using the electronic parts can also be simplified compared with the former.

[0022]

[Embodiment of the Invention] Since it has the protective coat which the electronic parts of this invention according to claim 1 covered the projection electrode formed on the connection electrode of the substrate equipped with the circuit element, and a circuit element, wiring and a projection electrode, and was formed and the whole is protected by the protective coat also including the top head of a projection electrode, by the time it mounts to the circuit board, the front face will not be polluted.

[0023] In electronic parts according to claim 1, a substrate is a semi-conductor substrate, and the electronic parts of this invention according to claim 2 can be characterized by a circuit element being a semiconductor device, and can offer the semi-conductor components of the CSP structure which the front face will not be polluted by the time it mounts to the circuit board, and was excellent in dependability.

[0024] The projection electrode formed on the connection electrode of the substrate with which the electronic parts of this invention according to claim 3 were equipped with the circuit element, While having the protective coat which covered the lid, and the substrate, projection electrode and lid of the hollow which covered the circuit element at least and was prepared, and was formed

and having the same effectiveness as invention according to claim 1 A lid can be mechanically protected from the production process of electronic parts before mounting process termination.

[0025] In electronic parts according to claim 3, a substrate is a piezo-electric substrate, and the electronic parts of this invention according to claim 4 can be characterized by a circuit element being a surface acoustic wave device, and can protect a lid mechanically before mounting-after production process process completion of electronic parts. Moreover, internal wiring is not corroded in the process which carries out the dicing of the substrate and divides it into each electronic parts.

[0026] In electronic parts according to claim 1 or 3, a protective coat is characterized by being an oxide film, a nitride, or an oxidation nitride, and the electronic parts of this invention according to claim 5 can protect a projection electrode more completely.

[0027] In claim 1 or claim 3, the electronic parts of this invention according to claim 6 are suitable for protecting at least jointing of a lid and a substrate from permeation of water mechanically especially again while they can be characterized by a protective coat being resin of thermosetting, thermoplasticity, or an ultraviolet curing mold and can apply it easily with easy equipment.

[0028] In electronic parts according to claim 6, the electronic parts of this invention according to claim 7 can lessen deformation of the projection electrode needed in case electronic parts are mounted in the circuit board while they can be characterized by the thickness of the protective coat in the top head of a projection electrode being thinner than the thickness in other fields and can fully protect electronic parts. That is, in order to join the projection electrode which has a protective coat on a top head to the circuit board, the protective coat of a top head will be crushed by deformation of a projection electrode in a junction process, a projection electrode and a connection terminal need to contact directly, and this phenomenon will be realized by deformation of a projection electrode.

[0029] The manufacture approach of the electronic parts of this invention

according to claim 8 The process which forms on a substrate wiring which has a circuit element and a connection electrode, and the process which forms a projection electrode on a connection electrode, The process which covers a circuit element and forms a lid in the air, and the process which carries out adsorption immobilization of the substrate at a rotation coater, rotates after resin is dropped at a substrate, covers a substrate, a lid, and a projection electrode, and forms the resin film, While having the process divided into the electronic parts of back each which stiffened the resin film and being able to fill up at least the joint of a lid and a substrate with sufficient resin for the origin of a projection electrode, thickness of the resin of the top head of a projection electrode can be made thin.

[0030] In the manufacture approach according to claim 8, the manufacture approach of the electronic parts of this invention according to claim 9 can be characterized by the ability of the revolving shaft of a rotation coater to incline from a vertical to the include angle of arbitration, and can fully fill up at least the joint of a lid and a substrate with resin.

[0031] The manufacture approach of the electronic parts of this invention according to claim 10 It is what is characterized by performing at least one of the impressing a supersonic wave to a substrate after dropping overheating a substrate to the temperature below the hardening initiation temperature of resin in the manufacture approach according to claim 8 or 9 before and after dropping resin at a substrate, and resin. At least the joint of a lid and a substrate can remove more completely the air bubbles generated in resin.

[0032] In claim 8, claim 9, or claim 10, the container which surrounds a rotation base at least is constituted possible [reduced pressure], and the manufacture approach of the electronic parts of this invention according to claim 11 can trickle resin into the substrate by which adsorption immobilization was carried out on the rotation base, after decompressing a container and evading the law, it can rotate a rotation base, and it can carry out degassing more completely. Moreover, after carrying out degassing, by leaning and rotating a revolving shaft to an apparent

vertical, the resin film can be formed still more effectively.

[0033] Since it is not characterized by to have the process which makes ultrasonic connection of the process which carries out alignment of claim 1 thru/or the projection electrode of electronic parts according to claim 7 to the connection terminal of the circuit board, and a projection electrode and a connection terminal and a projection electrode is not polluted before mounting to the circuit board from manufacture of electronic parts, the high junction of the reliability of a connection terminal and a projection electrode of invention of this invention according to claim 12 is attained.

[0034] In the manufacture approach according to claim 12, invention of this invention according to claim 13 can be characterized by having a height thin enough compared with the overall diameter of a projection electrode on the top head of a projection electrode, and can crush the protective coat of a top head easily according to this structure.

[0035] In the manufacture approach according to claim 12, invention of this invention according to claim 14 can be characterized by adding heat and a load to electronic parts with a supersonic wave at the process which makes ultrasonic connection, and can crush the protective coat of the top head of a projection electrode easily.

[0036] In the manufacture approach according to claim 12, invention of this invention according to claim 15 can be characterized by impressing a supersonic wave, after the process which makes ultrasonic connection carries out the pressure welding of the projection electrode to a connection terminal and crushes the protective coat of the top head of a projection electrode, and it can join a projection electrode and a connection terminal easily.

[0037] In the manufacture approach according to claim 12, the circuit board is a ceramic substrate or a metal substrate which has an insulating layer in a principal plane at least, invention of this invention according to claim 16 is characterized by supplying a supersonic wave from both sides of the rear face of electronic parts, and the rear face of the circuit board, and becomes that it is easy to

centralize powerful ultrasonic energy on the interface of a projection electrode and a connection terminal, and firm junction is acquired.

[0038] In the manufacture approach according to claim 16, invention of this invention according to claim 17 is characterized by enlarging energy of the supersonic wave supplied from a circuit board side compared with the energy of the supersonic wave supplied from an electronic-parts side, and becomes that it is easy to centralize the still more powerful ultrasonic energy to the interface of a projection electrode and a connection terminal, and firm junction is acquired.

[0039] Invention of this invention according to claim 18 is set to the manufacture approach according to claim 12. Before the process which carries out alignment, the projection electrode of electronic parts, and the connection terminal of the circuit board It is what is characterized by adding the process at which the front face carries out rotation or at least one of the carrying out a horizontal movement for pressing a projection electrode to the level pedestal which is a split face for polish, and sliding electronic parts in a horizontal plane, and a level pedestal, and crushes the protective coat of the top head of a projection electrode. The protective coat of the top head of a projection electrode can be crushed and removed more completely.

[0040] Hereafter, the gestalt of operation of this invention is explained using drawing 8 from drawing 1 .

[0041] (Gestalt 1 of operation) Drawing 1 is the important section sectional view of the semi-conductor components in the gestalt 1 of operation of this invention.

[0042] The semiconductor device 3 with which the semi-conductor components 1 in the gestalt of this operation consist of a transistor, a resistance element, internal wiring, etc. on the semi-conductor substrate 2 is formed, and the projection electrode 5 is formed on the connection electrode 4. Furthermore the semi-conductor substrate 2, a semiconductor device 3, and the projection electrode 5 are covered, and the resin film 6 as a protective coat is formed.

[0043] Such semi-conductor components 1 are manufactured according to the following process. First, many semiconductor devices 3 are formed on a semi-

conductor wafer according to a semi-conductor manufacture process. Next, the projection electrode 5 is formed on the connection electrode 4 of a semiconductor device 3. Gold, aluminum, an aluminium alloy, copper, etc. are used as an ingredient of the projection electrode 5. Next, the resin film 6 is formed with a spin coat method etc. all over a semi-conductor wafer. Next, a semi-conductor wafer is divided into each semi-conductor components 1.

[0044] Thus, by the time it mounts the semi-conductor components 1 in the circuit board, the front face of the projection electrode 5 will be polluted, or the obtained semi-conductor components 1 do not oxidize, though the projection electrode was formed using the metal which is easy to oxidize in addition to gold, since the whole of the front face was covered by the resin film 6.

[0045] Moreover, in order to mount the semi-conductor components 1 with which the principal plane was covered by the resin film 6 including the projection electrode 5 in this way in the circuit board, after crushing the resin film 6 of the top head of the projection electrode 5 just before mounting, it can carry out by carrying out bonding, or carrying out the pressure welding of the top head of the projection electrode 5 to the connection terminal of the circuit board at the time of bonding, and crushing and carrying out bonding of the resin film 6 of a top head.

[0046] (Gestalt 2 of operation) Drawing 2 is the important section sectional view of the electronic parts which make an example the surface acoustic wave device in the gestalt 2 of operation of ********.

[0047] As shown in drawing 2 , the electronic parts 7 equipped with the surface acoustic wave device The connection electrode 10 drawn from the surface acoustic wave device which has the INTADIJITARU transducer electrode (it is usually called an IDT electrode) 9, and the IDT electrode 9 is formed in the front face of the piezo-electric substrate 8. The active region of a surface acoustic wave device is covered with the lid 12 which has oscillating space, the projection electrode 11 is formed on the connection electrode 10, the top head of the projection electrode 11 and a lid 12 top are also covered further, and the resin film 13 is formed.

[0048] Since that front face is covered by the resin film 13, by the time it mounts electronic parts 7 in the circuit board like the semi-conductor components stated with the gestalt 1 of operation also in this case, the front face of the projection electrode 11 will be polluted, or it does not oxidize.

[0049] Moreover, although the lid 12 was generally formed using the photosensitive dry film resist (henceforth a film resist), cautions were required, since the whole mechanical strength and the adhesion reinforcement like the joint of a lid 12 and the piezo-electric substrate 8 were not so strong to deal with it as electronic parts. However, since a mechanical strength improves and it is completely protected also in the joint of a lid 12 and the piezo-electric substrate 8 by protecting the whole by the resin film 13 like this operation gestalt, there is no corrosion of the IDT electrode 9 by permeation of water.

[0050] Moreover, in order for the principal plane to mount the electronic parts 7 covered by the resin film 13 in the circuit board including the projection electrode 11 in this way After crushing the resin film 13 of the top head of the projection electrode 11 similarly with the gestalt 1 of operation having described just before mounting, it can carry out by carrying out bonding, or carrying out the pressure welding of the top head to the connection terminal of the circuit board at the time of bonding, and crushing and carrying out bonding of the resin film 13 of a top head.

[0051] (Gestalt 3 of operation) The gestalt 3 of operation is a process sectional view for drawing 3 (f) to explain the manufacture approach from drawing 3 (a) about the manufacture approach of electronic parts equipped with the surface acoustic wave device stated to the gestalt 2 of operation.

[0052] As first shown in drawing 3 (a), many surface acoustic wave devices which consist of an IDT electrode 9 and connection electrode 10 grade are formed on the piezo-electric substrate 8. In addition, 14 is a cutting plane line for dividing into each electronic parts 7 from the piezo-electric substrate 8.

[0053] Next, as shown in drawing 3 (b), the active region of a surface acoustic wave device is covered, and a lid 12 is formed. This lid 12 sticks a film resist all

over the piezo-electric substrate 8 with which the surface acoustic wave device was formed first, exposes and develops it, and forms the side-attachment-wall section of a lid 12. Next, a film resist is stuck on the whole surface, negatives are exposed and developed, and the head-lining section of a lid 12 is formed.

[0054] Next, as shown in drawing 3 (c), the projection electrode 11 is formed on the connection electrode 10. After the projection electrode 11 forms a golden ball at the tip of a gold streak like the wirebonding method which used the gold streak, it uses the golden ball for the front face of the connection electrode 10, carries out the pressure welding of the ultrasonic thermocompression bonding and forms a projection electrode, it is formed by the approach of cutting a gold streak by the point.

[0055] Next, as shown in drawing 3 (d), after laying the piezo-electric substrate 8 on the rotation base 15 of a rotation coater and dropping liquefied resin 17, the rotation base 15 is rotated, resin is applied, and as shown in drawing 3 (e), the resin film 13 is formed. In addition, 16 shows the revolving shaft of the rotation base 15.

[0056] Next, by cutting the piezo-electric substrate 8 along with a cutting plane line 14, the electronic parts 7 shown in drawing 3 (f) with which the whole surface including the top head of the projection electrode 11 was covered by the resin film 13 are obtained.

[0057] (Gestalt 4 of operation) Drawing 4 (a) and drawing 4 (b) are the sectional views for explaining the manufacture approach of the electronic parts in the gestalt 4 of operation of this invention.

[0058] in the rotation spreading process shown in drawing 3 (d), arbitration should wait [a revolving shaft 16] for the gestalt of this operation the degree of angle from a vertical axis 18 to be shown in drawing 4 (a) -- it enables it to incline In addition, as for the tilt angle theta to the apparent vertical 18 of a revolving shaft 16, it is desirable to decide experimentally in consideration of the viscosity of resin, specific gravity, the height of a lid, etc.

[0059] Drawing 4 (b) is the important section sectional view of the electronic parts

which applied the resin film 13 by the approach shown in drawing 4 (a). That is, at least the joint of the piezo-electric substrate 8 and a lid 12 can fully fill up with and apply liquefied resin 17 by leaning a revolving shaft 16 at 12b. Therefore, improvement in the mechanical strength of a lid 12 and improvement of adhesion reinforcement to the piezo-electric substrate 8 of a lid 12 can be realized, and permeation of the water from joint grade can be prevented further. In this case, liquefied resin 17 can be made much more easy to fill up the side-attachment-wall section of a lid 12 by making it rotate, liquefied resin 17 being dropped where a revolving shaft 16 is first set by the vertical axis 18, and making a revolving shaft 16 incline after an appropriate time, or making it incline.

[0060] Moreover, the air bubbles with which at least the joint of a lid 12 and the piezo-electric substrate 8 much more becomes easy to be filled up with liquefied resin 17 by 12b, and is contained at least in the inside of liquefied resin 17 or a joint are easily removable by heating the piezo-electric substrate 8 at the temperature below the hardening initiation temperature of liquefied resin 17, before and after dropping resin at the piezo-electric substrate 8.

[0061] Moreover, after liquefied resin 17 is dropped at the piezo-electric substrate 8, the air bubbles with which at least the inside of liquefied resin 17 or a joint is contained in 12b are easily removable by impressing a supersonic wave to the piezo-electric substrate 8.

[0062] Moreover, the air bubbles with which at least the inside of liquefied resin 17 or a joint is contained in 17b can be more completely removed by heating the piezo-electric substrate 8, before and after dropping liquefied resin 17, and impressing a supersonic wave, after dropping liquefied resin 17.

[0063] Moreover, after enabling reduced pressure of the container of a rotation coater which surrounds the rotation base 15 at least and dropping liquefied resin 17, air bubbles are not contained in 17b at least for the inside of liquefied resin 17, and a joint by decompressing the inside of a container and carrying out degassing of the inside of liquefied resin 17.

[0064] (Gestalt 5 of operation) Drawing 5 (a) and (b) are the process sectional

views for explaining the manufacture approach of the electronic-circuitry equipment in the gestalt 5 of operation of this invention. In the gestalt of this operation, although semi-conductor components were explained as an example, the connection electrode etc. was omitted.

[0065] As shown in drawing 5 (a), the internal wiring 20 and passive circuit elements 21, and connection terminal 22 grade are formed on the circuit board 19. Adsorption maintenance of the semi-conductor components 1 is carried out by the vacuum chuck 23, and alignment of the projection electrode 5 and the connection terminal 22 is carried out. In this condition, the principal plane of the semi-conductor components 1 is covered by the resin film 6 including the top head of the projection electrode 5.

[0066] Next, as shown in drawing 5 (b), by carrying out the pressure welding of the projection electrode 5 to the connection terminal 22, the parietal region of the projection electrode 5 is made to deform, and the resin film 6 is crushed. The projection electrode 5 and the connection terminal 22 will contact directly by it, and both will be joined by the supersonic wave.

[0067] Since according to the gestalt of this operation semi-conductor components will be mounted in the circuit board 19 after the resin film 6 has remained on the projection electrode 5, the process at which the resin film 6 is ground in the state of a wafer like the manufacture approach of conventional CSP, and the top head of the projection electrode 5 is exposed becomes unnecessary.

[0068] In addition, a configuration as shown in the sectional view shown in drawing 6 as a configuration of the projection electrode 5 is desirable. Such a projection electrode 5 of a configuration can form a golden ball at the tip of a gold streak used well in recent years, and can form it easily by carrying out ultrasonic thermocompression bonding of it. In this case, when a pressure welding is carried out to the circuit board 19 connection terminal 22 which shows the projection electrode 5 to drawing 5 , and the part of this height 5a deforms first, the resin film 6 of the parietal region will be crushed very easily, the projection

electrode 5 and the connection terminal 22 will contact directly, and a good junction condition is acquired [since height 5a thin enough is formed compared with the overall diameter of the projection electrode 5,]. In addition, the configuration of height 5a to need can realize easily the tip configuration of the tool used when sticking a golden ball to a connection terminal by pressure by processing the predetermined configuration.

[0069] Moreover, a still firmer junction condition is acquired by heating with a supersonic wave at the time of junction for the projection electrode 5 and the connection terminal 22.

[0070] Moreover, after carrying out the pressure welding of the projection electrode 5 to the connection terminal 22 and fully crushing the resin film 6 of the parietal region of the projection electrode 5, the method of impressing a supersonic wave is also effective.

[0071] Moreover, as the circuit board 22, at least, when a ceramic substrate or the metal substrate which has an insulating layer on a front face is used, still firmer junction can be easily realized by supplying a supersonic wave also from circuit board side 19. That is, since ultrasonic energy concentrates on the interface of the projection electrode 5 and the connection terminal 22 from both sides, compared with the case where a supersonic wave is impressed, larger energy can be centralized on an interface only from the semi-conductor components 1 side.

[0072] That is, although problems, like slipping arises are between a vacuum chuck 23 and the semi-conductor components 1 when the supersonic wave of big energy is impressed from the semi-conductor components 1 side, big ultrasonic energy as a result can be centralized on an interface by making small ultrasonic energy impressed from the semi-conductor components 1 side, and enlarging ultrasonic energy from a circuit board 19 side.

[0073] In addition, although the gestalt of this operation explained semi-conductor components as an example, it can be applied also to the case where the electronic parts which covered the surface acoustic wave device and

prepared the lid are used, and has the same operation effectiveness.

[0074] (Gestalt 6 of operation) It is a process sectional view for drawing 7 (c) to explain the manufacture approach of the electronic-circuitry equipment in the gestalt 6 of operation of this invention from drawing 7 (a). The gestalt of this operation crushes the resin film 6 of the parietal region of the projection electrode 5 on the polish base 24 prepared beforehand, before joining the projection electrode 5 to the connection terminal 22.

[0075] as first shown in drawing 7 (a), or it adsorbs the semi-conductor components 1 with which the resin film 6 was formed in the whole surface including the projection electrode 5 by the vacuum chuck 23, it pushes against the split face 25 for polish of the polish base 24 and it carries out the horizontal movement of the vacuum chuck 23 -- the polish base 24 -- a horizontal movement -- or it is made to rotate It becomes possible to remove the resin film 6 of the parietal region, without destroying the projection electrode 5 by adjusting the granularity of the load impressed to the semi-conductor components 1, and the split face 25 for polish etc. at this time.

[0076] The resin film 6 of the parietal region of the projection electrode 5 is removed, and drawing 7 (b) shows the condition that the exposure 26 was formed in the top head of a projection electrode. After that, as shown in drawing 7 (c), alignment of the projection electrode 5 is carried out to the connection terminal 22 of the circuit board 19 installed on the substrate standing ways 26, and a supersonic wave is impressed and it joins.

[0077] Thus, the semi-conductor components 1 which have the projection electrode 5 formed using the metal with which copper etc. tends to oxidize by the approach of removing the resin film 6 of the top head of the projection electrode 5 just before mounting the semi-conductor components 1 in the circuit board 19 since the front face of the projection electrode 5 was held to the time at clarification can also realize reliable junction.

[0078] In addition, although it followed the example of semi-conductor components, the above-mentioned explanation equips a front face with a surface

acoustic wave device, it is completely the same, and much more effectiveness can demonstrate it compared with semi-conductor components. [of the electronic parts which protected the part with the lid]

[0079]

[Effect of the Invention] As explained above, the electronic parts of this invention are what has the protective coat which covered the projection electrode formed on the connection electrode of the substrate equipped with a circuit element and wiring, and a circuit element, wiring and a projection electrode, and was formed. Since the projection electrode is covered by the protective coat, even when the front face is not polluted and a projection electrode is formed with the metal with which copper etc. tends to oxidize, it is possible to hold the front face to clarification to a mounting phase.

[0080] This invention is equipped with the surface acoustic wave device which formed the IDT electrode on the piezo-electric substrate further, and demonstrates the effectiveness which was excellent in the electronic parts which covered the active region with the lid. That is, generally, although usually formed by the aluminum film or the aluminium alloy film, since an IDT electrode cannot form a protective coat in a front face in a surface acoustic wave device, it is unreserved except the active region covered with the lid. In this case, although it is easy to generate electrochemical corrosion on the boundary of gold and aluminum when a projection electrode is formed with a golden ball, the whole surface is not corroded like this invention in the electronic parts covered by the resin film.

[0081] Moreover, although the adhesion of the joint of the side attachment wall and head-lining section and the joint of a side attachment wall and a piezo-electric substrate is weak, and the lid itself is mechanically weak, although a lid is generally formed using a film resist, and there is a problem of permeation of the water from the joint of a side attachment wall and a piezo-electric substrate, these problems are solved by covering the whole by the resin film like this invention.

[0082] Moreover, in the manufacture approach of conventional CSP, polish or the process at which grinding is carried out and the top head of a projection electrode is exposed is unnecessary in this invention in the front face in the state of the important substrate of the diameter of macrostomia, and a man day can be reduced.

[Translation done.]

* NOTICES *

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damages caused by the use of this translation.
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The important section sectional view of the semi-conductor components in the gestalt 1 of operation of this invention
[Drawing 2] The important section sectional view of the electronic parts which make an example the surface acoustic wave device in the gestalt 2 of operation of this invention
[Drawing 3] (a) - (f) is a process sectional view for explaining the manufacture approach of the electronic parts in the gestalt 3 of operation of this invention.
[Drawing 4] (a) and (b) are a sectional view for explaining the manufacture approach of the electronic parts in the gestalt 4 of operation of this invention.
[Drawing 5] (a) and (b) are a process sectional view for explaining the

manufacture approach of the electronic-circuitry equipment in the gestalt 5 of operation of this invention.

[Drawing 6] The important section sectional view for explaining the configuration of the projection electrode formed in the electronic parts in the gestalt 5 of operation of this invention

[Drawing 7] (a) - (c) is a process sectional view for explaining the manufacture approach of the electronic-circuitry equipment in the gestalt 6 of operation of this invention.

[Drawing 8] (a) - (e) is a process sectional view for explaining the manufacture approach of the conventional electronic parts which make semi-conductor components an example, and electronic-circuitry equipment.

[Drawing 9] The important section sectional view for explaining the conventional electronic-circuitry equipment using electronic parts equipped with the surface acoustic wave device

[Description of Notations]

1 Semi-conductor Components (Electronic Parts)

2 Semi-conductor Substrate (Substrate)

3 Semiconductor Device (Circuit Element)

4 Connection Electrode

5 Projection Electrode

6 Resin Film (Protective Coat)

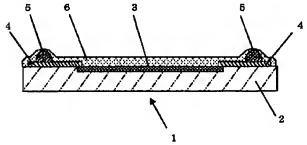
[Translation done.]

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

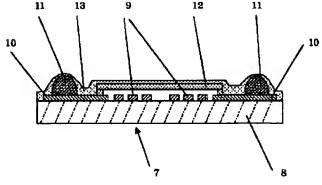
DRAWINGS

[Drawing 1]

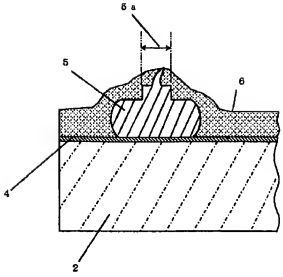


1 半導体部品（電子部品）
2 半導体基板（基板）
3 半導体デバイス（回路素子）
4 接続電極
5 突起電極
6 樹脂膜（保護膜）

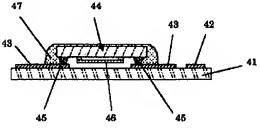
[Drawing 2]



[Drawing 6]



[Drawing 9]



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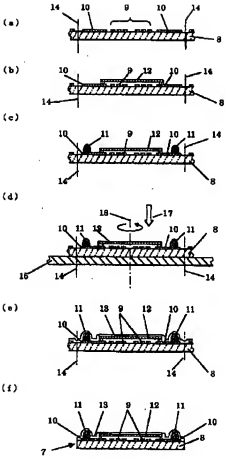
(a)
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(c)
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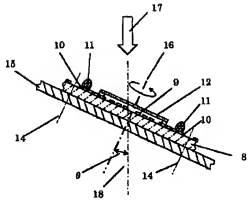
[Drawing 4]

(a)



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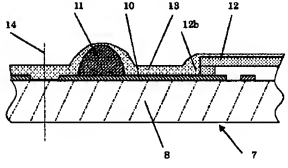
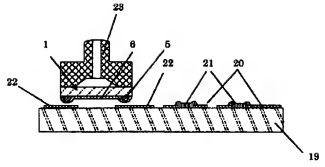


[Drawing 5]

(a)



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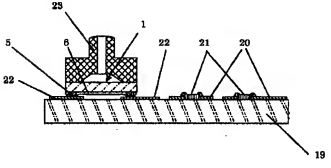
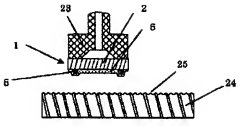


[Drawing 7]

(a)



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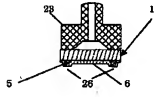
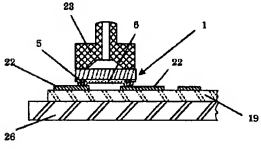
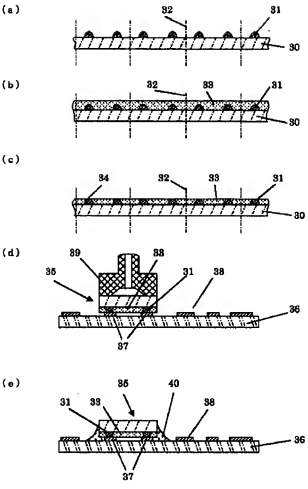


(c)



[Drawing 8]



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	21/60			23/28	Ｚ	5J097
	23/28		Ｈ０３Ｈ	3/08		
Ｈ０３Ｈ	3/08			9/25	Ａ	

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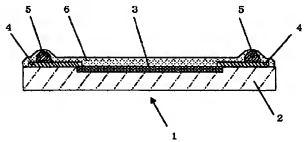
最終頁に続く

(54)【発明の名称】電子部品、電子部品の製造方法および電子回路装置の製造方法

(57)【要約】
【課題】　突起電極を用いて回路基板に接続するための電子部品において、電子部品の製造から回路基板への実装までの間に突起電極が汚染または酸化されることのない構造、その製造方法および電子回路装置の製造方法を提供する。
【解決手段】　電子部品１は、回路素子３を備えた基板２の接続端子４上に形成された突起電極５と、回路素子３、突起電極５を覆って形成された保護膜６とを有しており、電子部品１の製造から回路基板への実装までの間に突起電極５が汚染または酸化されることがなく、回路基板の接続端子への信頼性の高い接合を実現することができる。



1　半導体部品（電子部品）
2　半導体基板（基板）
3　半導体デバイス（回路素子）
4　接続電極
5　突起電極
6　樹脂膜（保護膜）

【特許請求の範囲】

【請求項１】　回路素子を備えた基板の接続電極上に形成された突起電極と、前記回路素子、前記基板および前記突起電極を覆って形成された保護膜とを有する電子部品。

【請求項２】　基板が半導体基板で、回路素子が半導体デバイスであることを特徴とする請求項１に記載の電子部品。

【請求項３】　回路素子を備えた基板の接続電極上に形成された突起電極と、少なくとも前記回路素子を覆って設けられた中空の蓋体と、前記基板、前記突起電極および前記蓋体を覆って形成された保護膜とを有する電子部品。

【請求項４】　基板が圧電基板で、回路素子が表面弾性波素子であることを特徴とする請求項３に記載の電子部品。

【請求項５】　保護膜が、酸化膜、窒化膜または酸化窒化膜であることを特徴とする請求項１または請求項３に記載の電子部品。

【請求項６】　保護膜が、熱硬化性、熱可塑性または紫外線硬化型の樹脂であることを特徴とする請求項１または請求項３に記載の電子部品。

【請求項７】　突起電極の頂頭部における保護膜の厚さが、その他の領域における厚さより薄いことを特徴とする請求項５または請求項６に記載の電子部品。

【請求項８】　基板上に回路素子および接続電極を有する配線を形成する工程と、前記接続電極上に突起電極を形成する工程と、前記回路素子を覆って中空の蓋体を形成する工程と、回転塗布装置の回転台に前記基板を吸着固定し、前記基板に樹脂を滴下した後回転して前記基板、前記蓋体および前記突起電極を覆って樹脂膜を形成する工程と、前記樹脂膜を硬化させた後、個々の電子部品に分割する工程と、を有する電子部品の製造方法。

【請求項９】　回転塗布装置の回転軸が鉛直方向から任意の角度まで傾斜可能であることを特徴とする請求項８に記載の電子部品の製造方法。

【請求項１０】　基板に樹脂を滴下する前後に基板を樹脂の硬化開始温度以下の温度に加熱することおよび樹脂を滴下後に基板に超音波を印加することの少なくとも一つを行うことを特徴とする請求項８または請求項９に記載の電子部品の製造方法。

【請求項１１】　回転塗布装置の少なくとも回転台を囲む容器が減圧可能に構成されており、前記回転台に吸着固定された基板に樹脂を滴下した後容器を減圧して脱泡する工程を付加したことを特徴とする請求項８に記載の電子部品の製造方法。

【請求項１２】　回路基板上の接続端子に請求項１乃至請求項７のいずれかに記載の電子部品の突起電極を位置合わせする工程と、前記突起電極と前記接続端子とを超音波接続する工程と、を有する電子回路装置の製造方法。

【請求項１３】　突起電極が、頂頭部に突起電極の最大径に比べて細い突起部を有することを特徴とする請求項１２に記載の電子回路装置の製造方法。

【請求項１４】　超音波接続する工程において、電子部品に超音波とともに熱を加えることを特徴とする請求項１２に記載の電子回路装置の製造方法。

【請求項１５】　超音波接続する工程が、突起電極を接続端子に圧接して前記突起電極の頂頭部の保護膜を破砕した後に超音波を印加することを特徴とする請求項１２に記載の電子回路装置の製造方法。

【請求項１６】　回路基板がセラミック基板または少なくとも主面に絶縁層を有する金属基板であって、超音波が電子部品側および回路基板側の両方から供給されることを特徴とする請求項１２に記載の電子回路装置の製造方法。

【請求項１７】　電子部品側から供給される超音波のエネルギーに比べて、回路基板側から供給される超音波のエネルギーが大であることを特徴とする請求項１６に記載の電子回路装置の製造方法。

【請求項１８】　電子部品の突起電極と回路基板の接続端子とを位置合わせする工程の前に、その表面が研磨用粗面である水平基台に前記突起電極を押圧して電子部品を水平面内で摺動させることおよび水平基台を回転または水平動させることの少なくとも一方を行うことにより、前記突起電極の頂頭部の保護膜を破砕する工程を付加したことを特徴とする請求項１２に記載の電子回路装置の製造方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、信頼性に優れた電子部品、その電子部品の製造方法、および電子回路装置の製造方法に関するものである。

【０００２】

【従来の技術】近年、携帯電話を初めとする携帯型情報端末機器の小型・軽量・薄型化の要望が強くなり、関連する技術開発が多く行われてきている。そのために半導体部品を含む電子部品の小型・軽量化、さらにはそれらを用いた電子回路装置の小型・軽量・薄型化が必要不可欠になってきている。このように、電子部品が小型化するにつれて、電子部品の電極と回路基板の接続端子との接続部における面積が小さくなるために、接続部の信頼性を確保するための新たな技術が必要になってくる。

【０００３】半導体部品の小型化・薄型化に関してはチップスケールパッケージ（以下、ＣＳＰという）構造が開発されており、この技術は順次半導体部品以外に高周波電子部品等にも応用されてきている。

【０００４】ＣＳＰ構造の半導体部品に関してはそれぞれ特徴ある構造および製造方法が多く開発されている。例えば、特開平９－２３７８０６号公報、特開平１１－

２７４２４１号公報には、半導体部品の接続電極に半田バンプ、金ボールバンプ等の突起電極を形成した後、突起電極を完全に覆って樹脂膜を形成し、硬化させた後に樹脂膜の表面を研磨して突起電極の表面を露出させ、個々の半導体部品に分割する方法、およびそれらの半導体部品を回路基板に接続する方法が開示されている。これらの方法は、従来の樹脂モールド法によるＣＳＰ構造の半導体部品に比較して格段に薄型化・小型化を可能にしたものである。

【０００５】また、表面弾性波素子を備えた電子部品に関しても、特開平９－２４６９０５号公報には、表面弾性波素子の接続電極に突起電極を形成し、かつ表面弾性波素子の活性領域に蓋体をかぶせた構造を有する電子部品、また前出の電子部品を回路基板に接続し、蓋体を保護樹脂で覆った構造が開示されている。

【０００６】以下、従来の電子部品、電子部品の製造方法、およびそれを用いた電子回路装置の製造方法について、図８および図９を参照しながら説明する。

【０００７】図８（ａ）から図８（ｅ）は半導体部品を例とする従来の電子部品および電子回路装置の製造方法を説明するための工程断面図である。

【０００８】まず、図８（ａ）に示すように、半導体基板３０の上にはトランジスタ、抵抗等の回路素子を備えた半導体部品（図示せず）が多数個形成されており、その半導体部品の接続電極（図示せず）上に突起電極３１を形成する。また、３２は半導体基板３０を個々の半導体部品に分割するための仮想の切断線（以下、切断線という）を示している。

【０００９】次に図８（ｂ）に示すように、半導体基板３０の全面にスピンコート法を用いて突起電極３１を完全に覆って樹脂膜３３を形成する。次に、半導体基板３０の主面に形成された樹脂膜３３の表面を研磨または研削して、突起電極３１の先端表面（以下、頂頭部という）３４を露出させ、図８（ｃ）の形状を得る。次に、半導体基板３０の接続線３２に沿ってダイシングし、個々の半導体部品３５に分割する。

【００１０】次に図８（ｄ）に示すように、接続端子３７、内部配線３８等が形成された回路基板３６を準備し、真空チャック３９で半導体部品３５を吸引し保持して、その突起電極３１を接続端子３７に位置合わせした後、真空チャック３９に超音波を供給して、突起電極３１と接続端子３７とを接合する。

【００１１】次に図８（ｅ）に示すように、半導体部品３５の少なくとも周辺部を樹脂膜４０で被覆し、保護する。また、半導体部品３５をすべて覆って樹脂膜４０を形成した例もある。

【００１２】図９は、表面弾性波素子を備えた電子部品を用いた電子回路装置の例を説明する要部断面図である。図９に示すように、回路基板４１の上には内部配線４２、接続端子４３が形成されている。一方、電子部品４４には表面弾性波素子（図示せず）が形成されており、その表面弾性波素子の活性領域を覆って振動空間を有する蓋体４６が形成されている。４７は樹脂膜である。

【００１３】このような表面弾性波素子を備えた電子部品は、圧電基板４１の上に多数個の表面弾性波素子を形成する工程と、表面弾性波素子の活性領域を覆いかつ振動空間を有する蓋体４６を形成する工程と、接続電極上に突起電極４５を形成する工程と、個々の電子部品４４に分割する工程とを有する製造方法によって製造される。

【００１４】このようにして得られた電子部品４４の突起電極４５を回路基板４１上の接続端子４３に位置合わせした後、電子部品に超音波を印加して突起電極４５と接続端子４３とを接合する。その後に、電子部品４４の周辺部または電子部品の全体を樹脂膜４７で覆うことによって、表面弾性波素子を搭載した電子回路装置が形成されることになる。

【００１５】

【発明が解決しようとする課題】しかしながら、上記の従来の半導体部品の製造方法においては、突起電極を形成した後、半導体基板の状態で表面に樹脂を塗布し、樹脂を研磨または研削して突起電極の表面を露出させている。直径２０cmもの大口径の半導体基板の上に形成された樹脂膜を均一に研磨または研削することは困難であり、また工程自体が増えるという課題を有していた。

【００１６】また、突起電極の頂頭部を露出させた状態で個々の半導体部品に分割するのであるが、それ以降半導体部品を回路基板に実装するまでの間に突起電極の頂頭部が汚染されないように保管しなければならなかった。突起電極が金で構成されている場合は問題ないが、酸化されやすい金属で構成されている場合、突起電極の表面が酸化されることがある。

【００１７】また、上記の従来の表面弾性波素子を有する電子部品および電子回路装置の製造方法においても上記の半導体部品と同様の課題を有しており、また電子部品を回路基板に実装した後に周辺部を樹脂で保護する方法では、それまでの工程において蓋体の強度が充分とは言えないために、その取扱いに細心の注意を要するという課題を有していた。

【００１８】また、表面弾性波素子は圧電基板の主面にアルミニウム膜でＩＤＴ電極および接続電極を形成しているが、蓋体で覆われた領域以外の領域ではアルミニウム膜が露出している。また、アルミニウム膜からなる接続電極の上には突起電極として金ボールバンプが形成される。ダイシング工程においては基板に冷却水をかけるが、この冷却水による電極の腐食や蓋体への水の侵入が発生することがある。

【００１９】また圧電基板としては、ＬｉＴａＯ$_3$やＬｉＮｂＯ$_3$が用いられるが、これらの材料ではダイシン

グ時に発生する切断粉によって冷却水がアルカリ性になることがある。そのためにアルミニウム膜が腐食されたり、またアルミニウム膜からなる接続電極上に金ボールバンプが形成されている場合に、その界面において電気化学的腐食が発生したりすることがある。

【００２０】本発明は上記の従来の課題を解決するもので、突起電極の頂頭部をはじめ電子部品の主面を機械的にも環境的にも保護した電子部品およびその製造方法、ならびにその電子部品を用いた電子回路装置の製造方法を実現することを目的とするものである。

【００２１】

【課題を解決するための手段】この目的を達成するために本発明の電子部品は、回路素子を備えた基板の接続電極上に形成された突起電極と、基板、回路素子および突起電極を覆って形成された保護膜とを有するものであり、電子部品を回路基板に実装するまでの間突起電極の先端表面を正常に保持することができ、また電子部品の製造方法およびその電子部品を用いた電子回路装置の製造方法も従来に比べて簡略化できるものである。

【００２２】

【発明の実施の形態】本発明の請求項１に記載の電子部品は、回路素子を備えた基板の接続電極上に形成された突起電極と、回路素子、配線および突起電極を覆って形成された保護膜とを有するものであり、突起電極の頂頭部も含んで全体が保護膜で保護されているため回路基板へ実装するまでにその表面が汚染されることがない。

【００２３】本発明の請求項２に記載の電子部品は、請求項１に記載の電子部品において、基板が半導体基板で、回路素子が半導体デバイスであることを特徴とするもので、回路基板へ実装するまでにその表面が汚染されることがなく、また信頼性に優れたＣＳＰ構造の半導体部品を提供することができる。

【００２４】本発明の請求項３に記載の電子部品は、回路素子を備えた基板の接続電極上に形成された突起電極と、少なくとも回路素子を覆って設けられた中空の蓋体と、基板、突起電極および蓋体を覆って形成された保護膜とを有するものであって、請求項１に記載の発明と同様の効果を有するとともに、電子部品の製造工程から実装工程終了までの間、蓋体を機械的に保護することができる。

【００２５】本発明の請求項４に記載の電子部品は、請求項３に記載の電子部品において、基板が圧電基板で、回路素子が表面弾性波素子であることを特徴とするもので、電子部品の製造工程後実装工程完了までの間で蓋体を機械的に保護することができる。また基板をダイシングして個々の電子部品に分割する工程において内部配線が腐食されることはない。

【００２６】本発明の請求項５に記載の電子部品は、請求項１または請求項３に記載の電子部品において、保護膜が、酸化膜、窒化膜または酸化窒化膜であることを特徴とするもので、突起電極をより完全に保護できる。

【００２７】本発明の請求項６に記載の電子部品は、請求項１または請求項３において、保護膜が熱硬化性、熱可塑性または紫外線硬化型の樹脂であることを特徴とするもので、簡単な装置で容易に塗布することができるとともに、特に蓋体と基板との接着部位を機械的にまた水の浸入から保護するのに適している。

【００２８】本発明の請求項７に記載の電子部品は、請求項６に記載の電子部品において、突起電極の頂頭部における保護膜の厚さが、その他の領域における厚さより薄いことを特徴とするもので、充分に電子部品を保護することができるとともに、電子部品を回路基板に実装する際に必要とする突起電極の変形を少なくすることができる。すなわち、頂頭部に保護膜を有する突起電極を回路基板に接合するためには、接合工程において頂頭部の保護膜は突起電極の変形によって破砕されて突起電極と接続端子とが直接接触する必要があり、この現象は突起電極の変形によって実現されることになる。

【００２９】本発明の請求項８に記載の電子部品の製造方法は、基板上に回路素子および接続電極を有する配線を形成する工程と、接続電極上に突起電極を形成する工程と、回路素子を覆って中空の蓋体を形成する工程と、回転塗布装置に基板を吸着固定し、基板に樹脂を滴下した後回転して基板、蓋体および突起電極を覆って樹脂膜を形成する工程と、樹脂膜を硬化させた後個々の電子部品に分割する工程とを有するものであり、蓋体と基板との接合部位におよび突起電極の根本に充分の樹脂を充填することができるとともに、突起電極の頂頭部の樹脂の厚さを薄くすることができる。

【００３０】本発明の請求項９に記載の電子部品の製造方法は、請求項８に記載の製造方法において、回転塗布装置の回転軸が鉛直方向から任意の角度まで傾斜できることを特徴とするもので、蓋体と基板との接合部位に樹脂を十分に充填することができる。

【００３１】本発明の請求項１０に記載の電子部品の製造方法は、請求項８または請求項９に記載の製造方法において、基板に樹脂を滴下する前後に基板を樹脂の硬化開始温度以下の温度に過熱することおよび樹脂を滴下後に基板に超音波を印加することの少なくとも一つを行うことを特徴とするもので、蓋体と基板との接合部位および樹脂中に発生する気泡をより完全に除去することができる。

【００３２】本発明の請求項１１に記載の電子部品の製造方法は、請求項８、請求項９または請求項１０において、少なくとも回転台を囲む容器が減圧可能に構成されており、回転台に吸着固定された基板に樹脂を滴下し、容器を減圧して脱泡した後に回転台を回転するもので、より完全に脱泡することができる。また脱泡した後に回転軸を鉛直線に対して傾けて回転させることにより、さらに効果的に樹脂膜を形成することができる。

【００３３】本発明の請求項１２に記載の発明は、請求項１ないし請求項７に記載の電子部品の突起電極を回路基板の接続端子に位置合わせする工程と、突起電極と接続端子とを超音波接続する工程とを有することを特徴とするものであり、電子部品の製造から回路基板への実装までの間に突起電極が汚染されることがないため、接続端子と突起電極の信頼度の高い接合が可能となる。

【００３４】本発明の請求項１３に記載の発明は、請求項１２に記載の製造方法において、突起電極の頂頭部に突起電極の最大径に比べて十分に細い突起部を有することを特徴とするもので、この構造により容易に頂頭部の保護膜を破砕することができる。

【００３５】本発明の請求項１４に記載の発明は、請求項１２に記載の製造方法において、超音波接続する工程で電子部品に超音波とともに熱および加重を加えることを特徴とするものであり、突起電極の頂頭部の保護膜を容易に破砕することができる。

【００３６】本発明の請求項１５に記載の発明は、請求項１２に記載の製造方法において、超音波接続する工程が、突起電極を接続端子に圧接して突起電極の頂頭部の保護膜を破砕した後に超音波を印加することを特徴とするもので、突起電極と接続端子とを容易に接合することができる。

【００３７】本発明の請求項１６に記載の発明は、請求項１２に記載の製造方法において、回路基板がセラミック基板または少なくとも主面に絶縁層を有する金属基板であって、超音波が電子部品の裏面および回路基板の裏面の両面から供給されることを特徴とするもので、突起電極と接続端子との界面に強力な超音波エネルギを集中させやすくなり、強固な接合が得られる。

【００３８】本発明の請求項１７に記載の発明は、請求項１６に記載の製造方法において、電子部品側から供給される超音波のエネルギに比べて、回路基板側から供給される超音波のエネルギを大きくしたことを特徴とするもので、さらに突起電極と接続端子との界面に強力な超音波エネルギを集中させやすくなり、強固な接合が得られる。

【００３９】本発明の請求項１８に記載の発明は、請求項１２に記載の製造方法において、電子部品の突起電極と回路基板の接続端子とを位置合わせする工程の前に、その表面が研磨用粗面である水平基台に突起電極を押圧して電子部品を水平面内で摺動させることおよび水平基台を回転または水平動させることの少なくとも一つを行い突起電極の頂頭部の保護膜を破砕する工程を付加したことを特徴とするもので、突起電極の頂頭部の保護膜をより完全に破砕・除去することができる。

【００４０】以下、本発明の実施の形態について、図１から図８を用いて説明する。

【００４１】（実施の形態１）図１は本発明の実施の形態１における半導体部品の要部断面図である。

【００４２】本実施の形態における半導体部品１は、半導体基板２の上にトランジスタ、抵抗素子および内部配線等からなる半導体デバイス３が形成されたものであり、その接続電極４の上には突起電極５が形成されている。さらに半導体基板２、半導体デバイス３および突起電極５を覆って保護膜としての樹脂膜６が形成されている。

【００４３】このような半導体部品１は下記の工程によって製造される。まず、半導体製造プロセスによって半導体ウエハの上に多数個の半導体デバイス３を形成する。次に、半導体デバイス３の接続電極４の上に突起電極５を形成する。突起電極５の材料としては、金、アルミニウム、アルミニウム合金、銅などが用いられる。次に、半導体ウエハの全面にスピンコート法などにより樹脂膜６を形成する。次に、半導体ウエハを個々の半導体部品１に分割する。

【００４４】このようにして得られた半導体部品１は、その表面が全て樹脂膜６で覆われているために、金以外に酸化されやすい金属を用いて突起電極が形成されていたとしても、半導体部品１を回路基板に実装するまでの間に突起電極５の表面が汚染されたり、酸化されたりすることがない。

【００４５】また、このように突起電極５を含んでその主面が樹脂膜６で覆われた半導体部品１を回路基板に実装するには、実装の直前に突起電極５の頂頭部の樹脂膜６を破砕してからボンディングするか、またはボンディング時に突起電極５の頂頭部を回路基板の接続端子に圧接して頂頭部の樹脂膜６を破砕しボンディングすることによって行なうことができる。

【００４６】（実施の形態２）図２は本発明のの実施の形態２における表面弾性波素子を例とする電子部品の要部断面図である。

【００４７】図２に示すように、表面弾性波素子を備えた電子部品７は、圧電基板８の表面にインターディジタルトランスデューサ電極（通常ＩＤＴ電極という）９を有する表面弾性波素子およびＩＤＴ電極９から導出された接続電極１０が形成され、表面弾性波素子の活性領域は振動空間を有する蓋体１２で覆われ、接続電極１０の上には突起電極１１が形成され、さらに突起電極１１の頂頭部および蓋体１２の上をも覆って樹脂膜１３が形成されている。

【００４８】この場合も、実施の形態１で述べた半導体部品と同様に、その表面が樹脂膜１３で覆われているために電子部品７を回路基板に実装するまでの間に突起電極１１の表面が汚染されたり、酸化されたりすることがない。

【００４９】また、蓋体１２は一般に感光性ドライフィルムレジスト（以下、フィルムレジストという）を用いて形成されるが、全体の機械的強度および蓋体１２と圧電基板８との接合部位の密着強度がそれほど強くないた

めに電子部品として取り扱うには注意が必要であった。しかしながら、本実施形態のように全体を樹脂膜１３で保護することにより機械的強度が向上し、また、蓋体１２と圧電基板８との接合部位も完全に保護されるために水の浸入によるＩＤＴ電極９の腐食がない。

【００５０】また、このように突起電極１１を含んでその主面が樹脂膜１３で覆われた電子部品７を回路基板に実装するには、実施の形態１で述べたと同様に、実装の直前に突起電極１１の頂頭部の樹脂膜１３を破砕してからボンディングするか、またはボンディング時に頂頭部を回路基板の接続端子に圧接して頂頭部の樹脂膜１３を破砕しボンディングすることによって行うことができる。

【００５１】（実施の形態３）実施の形態３は、実施の形態２に述べた表面弾性波素子を備えた電子部品の製造方法に関するものであり、図３（ａ）から図３（ｆ）は、その製造方法を説明するための工程断面図である。

【００５２】まず図３（ａ）に示すように、圧電基板８の上にＩＤＴ電極９および接続電極１０等からなる表面弾性波素子を多数個形成する。なお、１４は圧電基板８から個々の電子部品７に分割するための切断線である。

【００５３】次に図３（ｂ）に示すように、表面弾性波素子の活性領域を覆って蓋体１２を形成する。この蓋体１２は、まず表面弾性波素子が形成された圧電基板８の全面にフィルムレジストを貼付け、露光・現像して蓋体１２の側壁部を形成する。次に全面にフィルムレジストを貼付け、露光・現像して蓋体１２の天井部を形成する。

【００５４】次に図３（ｃ）に示すように、接続電極１０の上に突起電極１１を形成する。突起電極１１は、金線を用いたワイヤボンディング法と同様に金線の先端に金ボールを形成し、その金ボールを接続電極１０の表面に超音波熱圧着法を用いて圧接して突起電極を形成した後その先端部で金線を切断する方法で形成される。

【００５５】次に図３（ｄ）に示すように、圧電基板８を回転塗布装置の回転台１５の上に載置し、液状樹脂１７を滴下した後回転台１５を回転させて樹脂を塗布し、図３（ｅ）に示すように樹脂膜１３を形成する。なお１６は回転台１５の回転軸を示す。

【００５６】次に切断線１４に沿って圧電基板８を切断することによって、突起電極１１の頂頭部を含め全面が樹脂膜１３で覆われた図３（ｆ）に示す電子部品７が得られる。

【００５７】（実施の形態４）図４（ａ）、図４（ｂ）は、本発明の実施の形態４における電子部品の製造方法を説明するための断面図である。

【００５８】本実施の形態は、図４（ａ）に示すように、図３（ｄ）に示す回転塗布工程において回転軸１６が鉛直軸１８から任意の角度まで傾斜できるようにしたものである。なお、回転軸１６の鉛直線１８に対する傾斜角θは、樹脂の粘性、比重、蓋体の高さ等を考慮して実験的に決めるのが望ましい。

【００５９】図４（ｂ）は図４（ａ）に示す方法によって樹脂膜１３を塗布した電子部品の要部断面図である。すなわち、回転軸１６を傾けることにより、圧電基板８と蓋体１２との接合部位１２ｂに液状樹脂１７を充分に充填・塗布することができる。したがって、蓋体１２の機械的強度の向上、蓋体１２の圧電基板８に対する密着強度の向上を実現でき、さらには接合部位からの水の浸入を防止できる。この場合、まず回転軸１６を鉛直軸１８に合せた状態で液状樹脂１７を滴下し、しかる後に回転軸１６を傾斜させるか、または傾斜させながら回転させることにより、蓋体１２の側壁部に液状樹脂１７をいっそう充填しやすくできる。

【００６０】また、圧電基板８に樹脂を滴下する前後に圧電基板８を液状樹脂１７の硬化開始温度以下の温度で加熱することにより、蓋体１２と圧電基板８の接合部位１２ｂによりいっそう液状樹脂１７を充填しやすくなり、液状樹脂１７中または接合部位に含まれる気泡を容易に除去することができる。

【００６１】また、圧電基板８に液状樹脂１７を滴下した後に圧電基板８に超音波を印加することにより、液状樹脂１７中または接合部位１２ｂに含まれる気泡を容易に除去することができる。

【００６２】また、液状樹脂１７を滴下する前後に圧電基板８を加熱し、液状樹脂１７を滴下後に超音波を印加することにより、液状樹脂１７中または接合部位１７ｂに含まれる気泡をより完全に除去することができる。

【００６３】また、回転塗布装置の少なくとも回転台１５を囲む容器を減圧可能にしておき、液状樹脂１７を滴下した後に容器内を減圧して液状樹脂１７中を脱泡することによって、液状樹脂１７中および接合部位１７ｂに気泡が含まれることがない。

【００６４】（実施の形態５）図５（ａ）、（ｂ）は、本発明の実施の形態５における電子回路装置の製造方法を説明するための工程断面図である。本実施の形態においては、半導体部品を例として説明するが、接続電極等は省略した。

【００６５】図５（ａ）に示すように、回路基板１９の上に内部配線２０および回路部品２１、接続端子２２等が形成されている。真空チャック２３で半導体部品１を吸着保持し、突起電極５と接続端子２２とを位置合わせする。この状態では、半導体部品１の主面は突起電極５の頂頭部を含んで樹脂膜６で覆われている。

【００６６】次に図５（ｂ）に示すように、突起電極５を接続端子２２に圧接することによって突起電極５の頭頂部を変形させ、樹脂膜６を破砕する。それによって突起電極５と接続端子２２とが直接接触し、超音波によって両者が接合されることになる。

【００６７】本実施の形態によれば、突起電極５の上に

樹脂膜６が残存した状態で半導体部品を回路基板１９に実装することになるため、従来のＣＳＰの製造方法のようにウエハ状態で樹脂膜６を研磨して突起電極５の頂頭部を露出させる工程が不要になる。

【００６８】なお、突起電極５の形状としては図６に示す断面図のような形状が望ましい。このような形状の突起電極５は、近年よく用いられている金線の先端に金ボールを形成し、それを超音波熱圧着することによって容易に形成することができる。この場合、突起電極５の最大径に比べて十分に細い突起部５ａが形成されるため、突起電極５を図５に示す回路基板１９接続端子２２に圧接した時に、まずこの突起部５ａの部分が変形することによって頭頂部の樹脂膜６が極めて容易に破砕され、突起電極５と接続端子２２が直接接触することになり、良好な接合状態が得られる。なお、必要とする突起部５ａの形状は、金ボールを接続端子に圧着するときに用いるツールの先端形状を所定の形状に加工しておくことにより、容易に実現することができる。

【００６９】また、突起電極５と接続端子２２との接合時に、超音波とともに加熱することによって、さらに強固な接合状態が得られる。

【００７０】また、突起電極５を接続端子２２に圧接し、突起電極５の頭頂部の樹脂膜６を十分に破砕した後に、超音波を印加する方法も有効である。

【００７１】また、回路基板２２としてセラミック基板または少なくとも表面に絶縁層を有する金属基板を用いた場合、回路基板側１９からも超音波を供給することにより、さらに強固な接合を容易に実現することができる。すなわち、突起電極５と接続端子２２との界面に両側から超音波エネルギが集中するため、半導体部品１側からのみ超音波を印加する場合に比べて、より大きいエネルギを界面に集中させることができる。

【００７２】すなわち、半導体部品１側から大きなエネルギの超音波を印加した場合、真空チャック２３と半導体部品１の間に滑りが生ずる等の問題があるが、半導体部品１側から印加される超音波エネルギを小さくし、回路基板１９側からの超音波エネルギを大きくすることによって、結果的には大きな超音波エネルギを界面に集中させることができる。

【００７３】なお、本実施の形態は半導体部品を例として説明したが、表面弾性波素子を覆って蓋体を設けた電子部品を用いた場合に対しても適用できるものであり、同様の作用効果を有するものである。

【００７４】（実施の形態６）図７（ａ）から図７（ｃ）は、本発明の実施の形態６における電子回路装置の製造方法を説明するための工程断面図である。本実施の形態は、突起電極５を接続端子２２に接合する前に、予め用意された研磨台２４の上で突起電極５の頭頂部の樹脂膜６を破砕するものである。

【００７５】まず図７（ａ）に示すように、突起電極５を含め全面に樹脂膜６が形成された半導体部品１を真空チャック２３で吸着し、研磨台２４の研磨用粗面２５に押しつけて、真空チャック２３を水平動させるか、研磨台２４を水平動または回転させる。このとき、半導体部品１に印加する加重、研磨用粗面２５の粗さ等を調整することにより、突起電極５を破壊することなく、頭頂部の樹脂膜６を除去することが可能となる。

【００７６】図７（ｂ）は、突起電極５の頭頂部の樹脂膜６が除去されて、突起電極の頂頭部に露出面２６が形成された状態を示している。その後に、図７（ｃ）に示すように、基板固定台２６の上に設置された回路基板１９の接続端子２２に突起電極５を位置合わせして、超音波を印加し、接合する。

【００７７】このように、半導体部品１を回路基板１９に実装する直前に突起電極５の頭頭部の樹脂膜６を除去する方法により、突起電極５の表面がその時点まで清浄に保持されるため、銅などの酸化されやすい金属を用いて形成した突起電極５を有する半導体部品１でも信頼性の高い接合を実現することができる。

【００７８】なお、上記の説明は半導体部品の例について行ったが、表面に表面弾性波素子を備え、その部分を蓋体で保護した電子部品でも全く同様であり、半導体部品に比べて一層の効果が発揮できるものである。

【００７９】

【発明の効果】以上説明したように、本発明の電子部品は、回路素子および配線を備えた基板の接続電極上に形成された突起電極と、回路素子、配線および突起電極を覆って形成された保護膜とを有するもので、突起電極が保護膜で覆われているためその表面が汚染されることがなく、また突起電極を銅等の酸化されやすい金属で形成した場合でも実装段階までその表面を清浄に保持することが可能である。

【００８０】本発明は、さらに圧電基板上にＩＤＴ電極を形成した表面弾性波素子を備え、その活性領域を蓋体で覆った電子部品において優れた効果を発揮するものである。すなわち、ＩＤＴ電極は通常アルミニウム膜またはアルミニウム合金膜で形成されるが、一般に、表面弾性波素子では表面に保護膜を形成することができないので、蓋体で覆われた活性領域以外は剥き出しになっている。この場合、突起電極を金ボールで形成した場合、金・アルミニウムの境界で電気化学的な腐食が発生しやすいが、本発明のように全面が樹脂膜で覆われている電子部品では、腐食されることがない。

【００８１】また、蓋体は一般的にフィルムレジストを用いて形成されるが、その側壁と天井部との接合部および側壁と圧電基板との接合部からの水の浸入の問題があるが、本発明のように全体が樹脂膜で覆われていることにより、これらの問題が解決される。

【００８２】また、従来のＣＳＰの製造方法において重要であった、大口径の基板の状態でその表面を研磨または研削して突起電極の頂頭部を露出させる工程が本発明では不要であり、工数が削減できる。

【図面の簡単な説明】

【図１】本発明の実施の形態１における半導体部品の要部断面図

【図２】本発明の実施の形態２における表面弾性波素子を例とする電子部品の要部断面図

【図３】（ａ）～（ｆ）は、本発明の実施の形態３における電子部品の製造方法を説明するための工程断面図

【図４】（ａ）、（ｂ）は、本発明の実施の形態４における電子部品の製造方法を説明するための断面図

【図５】（ａ）、（ｂ）は、本発明の実施の形態５における電子回路装置の製造方法を説明するための工程断面図

【図６】本発明の実施の形態５における電子部品に形成された突起電極の形状を説明するための要部断面図

【図７】（ａ）～（ｃ）は、本発明の実施の形態６における電子回路装置の製造方法を説明するための工程断面図

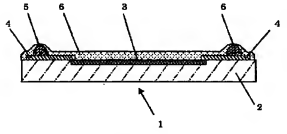
【図８】（ａ）～（ｅ）は半導体部品を例とする従来の電子部品および電子回路装置の製造方法を説明するための工程断面図

【図９】表面弾性波素子を備えた電子部品を用いた従来の電子回路装置を説明するための要部断面図

【符号の説明】

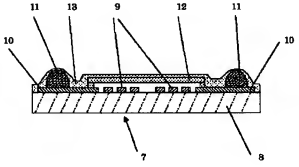
1　半導体部品（電子部品）
2　半導体基板（基板）
3　半導体デバイス（回路素子）
4　接続電極
5　突起電極
6　樹脂膜（保護膜）

【図１】

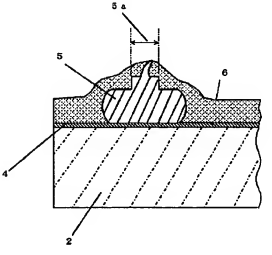


1　半導体部品（電子部品）
2　半導体基板（基板）
3　半導体デバイス（回路素子）
4　接続電極
5　突起電極
6　樹脂膜（保護膜）

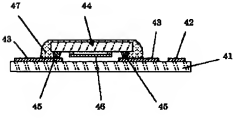
【図２】



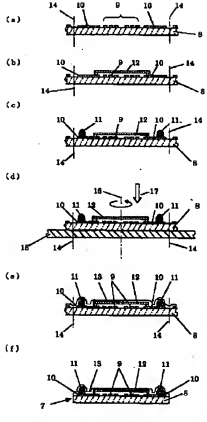
【図６】



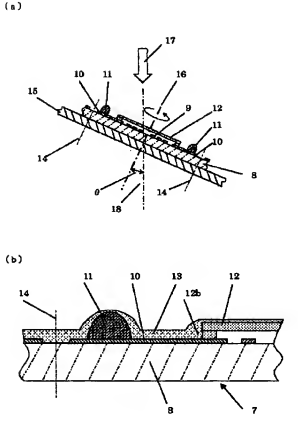
【図９】



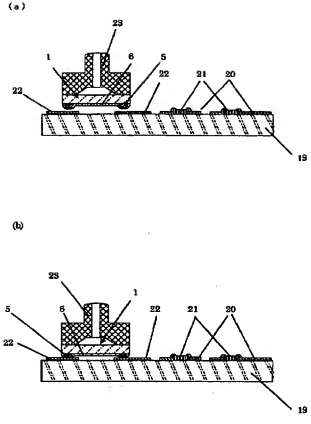
【図３】



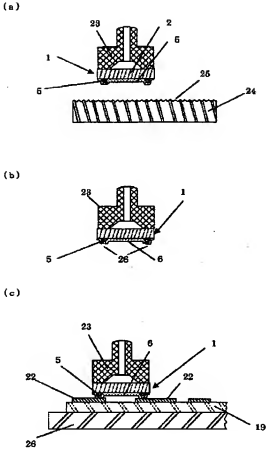
【図４】



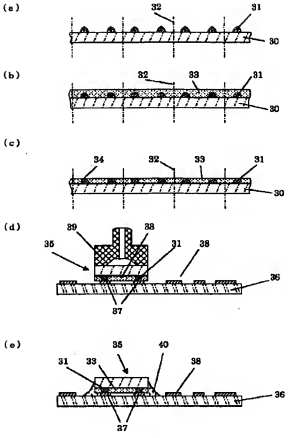
【図５】


(a)
23
1
6
5
22
21
20
22
19
(b)
23
1
5
6
22
21
20
22
19

【図７】


(a)
23
2
6
1
5
25
24
(b)
23
1
5
26
6
(c)
23
6
1
5
22
22
19
26

【図８】



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